

Engaging Citizen Scientists to Enhance Cloud Information from Satellite Remote Sensing



**CERES SCIENCE TEAM MEETING
EARTH RADIATION BUDGET WORKSHOP
OCTOBER 18TH-21ST, 2016**

**EUROPEAN CENTER FOR MEDIUM-RANGE WEATHER
FORECASTS (ECMWF)
SHINFIELD PARK, READING, UK**

**DR. PATRICK TAYLOR
SCIENCE DIRECTORATE**

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CERES Education and Communication

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Science Communications and Education

Education Team

Lin Chambers, Lead, Detailed to Headquarters

Jessica Taylor, On-site Lead

Ann Martin, Evaluator

Focus: CAN Award Education Components

NASA Champion: Lin Chambers

S'COOL/GLOBE Integration

Sarah McCrea

Support: Tina Rogerson

NASA Champion: Jessica Taylor/Lin
Chambers/Margaret Pippin

GLOBE at Langley Tina Harte

Support: Preston Lewis, Sarah
McCrea

NASA Champion: Lin Chambers

MY NASA DATA

Team Collaboration

Support: Tina Harte, Jill Teige,
Daniel Oostra, Penny Oots

Continuing Mission Related Education Support

CERES

Sarah McCrea

CALIPSO

Jessica Taylor

SAGE III on ISS

Kristyn Damadeo

TEMPO

Margaret Pippin

DISCOVER/KORUS-AQ

Amber Richards
Lin Chambers

Communications Team

Denise Lineberry

Aimee Amin
MaryAnn Jackson
Jay Madigan
Tim Marvel

** Additional Support from Translators Personnel (Camelia Dellar) and ASDC Personnel*

Reminder: New Plan

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NASA SD Education mainly funded through the NASA Cooperative Agreement Notice (CAN)

- Missions are no longer required to set aside 1% of funding for mission-specific education efforts
- Cooperative Agreements for **thematic** educational **content** and activities were awarded in late 2015. LaRC CAN Awards include:
 - **NESEC: Interagency Collaborations (NASA Earth Science: JPL, Goddard, Wallops...)**
 - **Mission Earth: Academic Collaborations (Tennessee University, Berkeley, Boston, Toledo, WestEd...)**
- Missions can still set aside funds for communications or fund additional education as needed.
- Full SMD Education awardee list:
<http://www.nasa.gov/feature/list-of-science-education-partners-for-nasa-stem-agreements>

Reminder: New Plan

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- **Communications**

- Earth Right Now
- Earth Observatory
- Science Visualization Studio

- **Education**

- Funded Projects from 2015 CAN Awards (NESEC, Mission Earth)
- The GLOBE Program
- MY NASA DATA
- S'COOL
- Office of Education Efforts: NIFS, Educator Professional Development, STEM Engagement activities, and Outreach Events

Science Directorate Education Scope

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Focus on providing many opportunities to involve educators (formal/informal), reaching students and the citizen science community, in real world science.

The SD EPO Team...

- Collaborates with the education community to bring authentic Earth science practices and real-world data into the classroom.
- Provides Learners with unique NASA experiences, engaging activities, and advanced technology.
- Provides products developed and reviewed by science and education experts.

Our goals include inspiring the next generation of Science, Technology, Engineering and Mathematics (STEM) professionals and improving STEM literacy by providing innovative participation pathways for educators, formal and informal, to reach students and the public.

New Education Priorities

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Current Initiatives

- S'COOL - Cloud Resources and Satellite Data Matching
- MYNASADATA – Website and Data Visualization
- GLOBE
 - National/International Partnerships
 - Elementary GLOBE
 - Field Campaigns
 - GLOBE Observer/Citizen Science
- 21CCLC- Collaboration with Department of Education
- TEMPO- Student Collaboration and C/PE
- NASA Earth System Science Award Intel ISEF
- Evaluation
- Agency/Langley/SD Support
- Outreach/Teacher Recruitment

New Communication Priorities

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NASA Communications

Agency Communications Priorities



Earth Right Now. *Your planet is changing. We're on it. #EarthRightNow*

NASA's fleet of satellites, its airborne missions and researchers address some of the critical challenges facing our planet today and in the future: climate change, sea level rise, freshwater resources, and extreme weather events.



ISS. *Off the Earth, for the Earth. #ISS*

The International Space Station is a blueprint for global cooperation and scientific advancements, a destination for growing a commercial marketplace in low-Earth orbit, and a test bed for demonstrating new technologies. The space station is the springboard to NASA's next great leap in exploration, including future missions to an asteroid and Mars.



Mars. *Join us on the journey. #JourneytoMars*

We are on a journey to Mars. Today our robotic scientific explorers are blazing the trail. Together, humans and robotics will pioneer the next giant leap in exploration.



Technology. *Technology drives exploration. #NASATech*

We develop, test and fly transformative capabilities and cutting edge exploration technologies. Our technology development provides the onramp for new ideas, maturing them from early stage through flight and giving wings to the innovation economy.



Aeronautics. *NASA is with you when you fly. #FlyNASA*

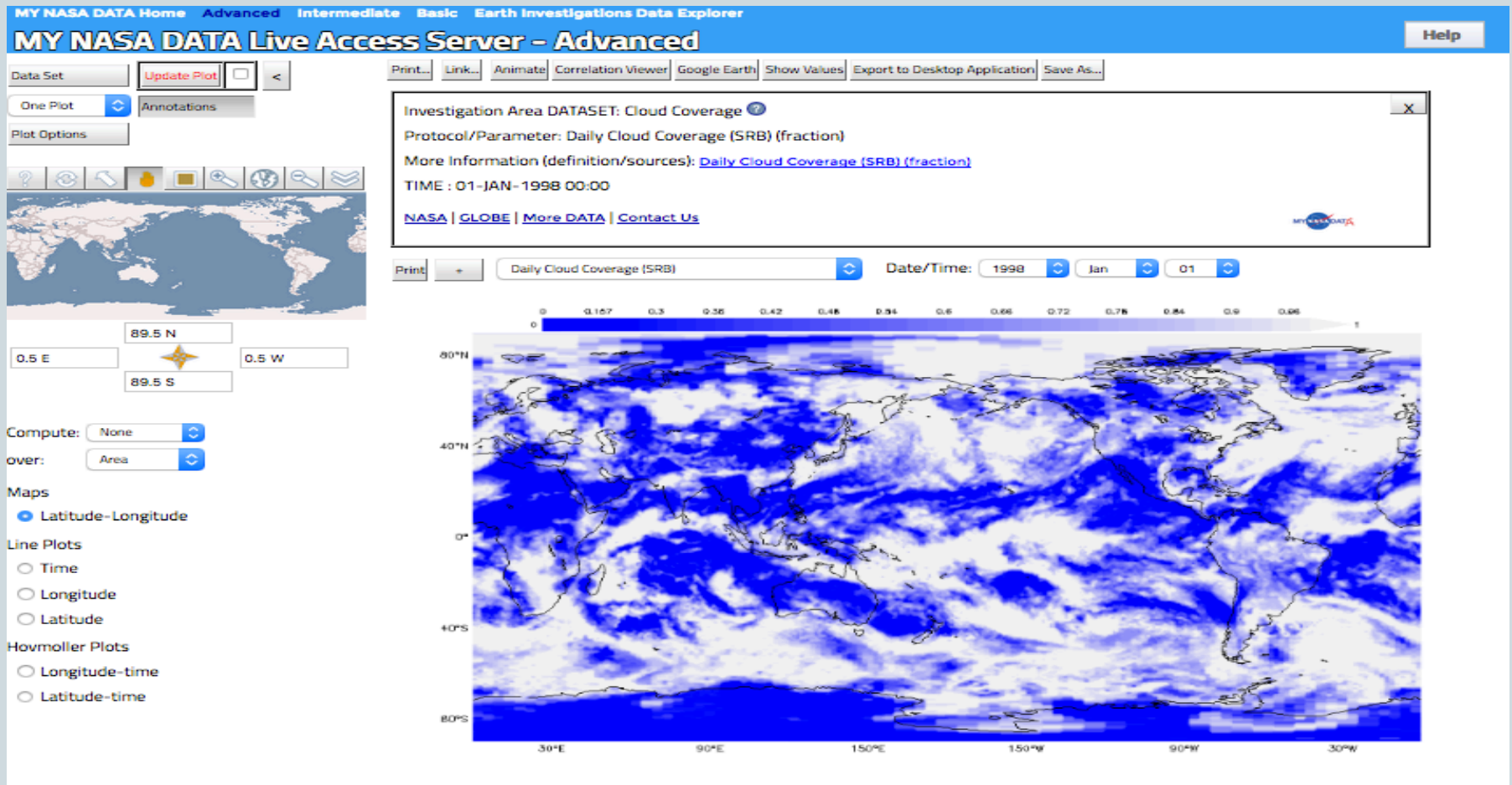
Every U.S. aircraft and air traffic control tower uses NASA-developed technology. We're committed to transforming aviation by reducing its environmental impact, maintaining safety, and revolutionizing aircraft shapes and propulsion.



Solar System and Beyond. *NASA: We're Out There. #NASABeyond*

NASA's exploration spans the universe. Observing the sun and its effects on Earth. Delving deep into our solar system. Looking beyond to worlds around other stars. Probing the mysterious structures and origins of our universe. Everywhere imaginable, NASA is out there.

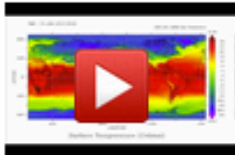

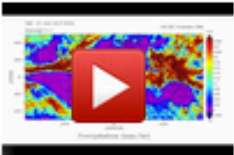
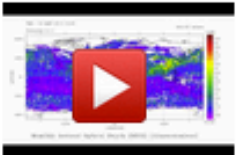


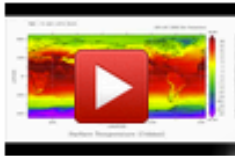


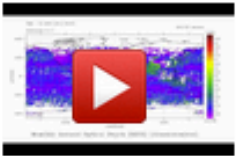


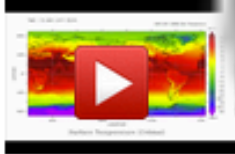

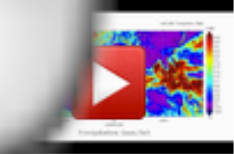
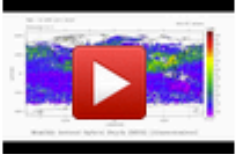


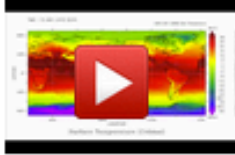
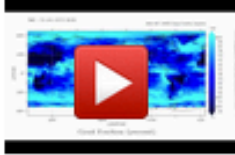
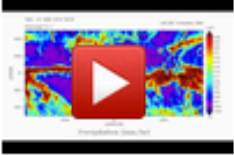
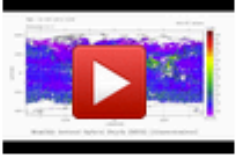

MY NASA DATA: Data Visualization



MY NASA DATA/GLOBE

Earth System Science Poster



	Insolation	Surface Temperature	Cloud Fraction	Precipitation	Aerosols	Biosphere
2013	Coming Soon!	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS
2012	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS
2011	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS
2010	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS	 Info Get Data LAS

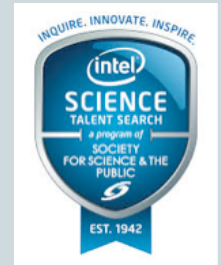
<https://mynasadata.larc.nasa.gov/globe/>

MY NASA DATA What's Next

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Moving Forward...

- NESEC asset for multiple applications to get NSAS Earth Science into the hands of Educators and Students.
- Collaboration with Intel ISEF and the Creation of the NASA Earth System Science Award Criteria
- Mission Earth partnership, vertically integrating NASA assets and resources across grade band and developing an effective educator professional development model.



The S'COOL Project: Cloud Ground Observation

Entry
Avenues

Formal
S'COOL

Informal
ROVER

Request
Sat.
Overpass

Observe
Clouds

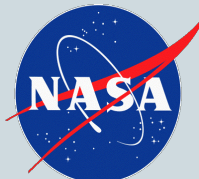
Report
Clouds

Explore Data
Match Email

2-Way Comm.

Match Email
Comment &
Analysis

Repeat



**Reaching Participants
Worldwide**

236,480
participants

132,734
ground observations

73,746
satellite matches

75
countries

17
Years

All 7
continents










S'COOL: Satellite Matching and Comparison


Match/Comparison Email

Observers will receive a 'Match' email when their observations have fallen within the selected overpass time period. The **ground observation** will be on the left and the **satellite observation** and images will be on the right.

Observer Information


Escuela	Latitud	Longitud	Ciudad	Estado	País
Colegio San Jose Hermanas Franciscanas Misioneras	4.612400	-74.092500	Bogota D.C	Outside U.S.-Canada	Colombia

Observación de Tierra: 99536				Satélite Terra				
Fecha: 2011-07-14		Hora Local: 10:12	Hora Universal: 15:12	Fecha: 2011-07-14		Universal Time: 15:17:00		
Opacidad	Cubierta de Nube	Tipo	Visualización		Altitude (km)	Opacity	Cloud Cover	Phase Temp(K)
					6.72	Opaco 12.72	Parte Nublado (5% to 50%) 15.93	hielo 258.77
					4.91	Opaco 19.7	Casi Todo Nublado (50% to 95%) 77.95	mixed 269.85
Transluciente	Todo (95% to 100%)	Estratocumulo						

Estelas Persistente: 0 Estelas Pasajera: 0	
Observaciones Superficiales Nieve/Hielo: Agua Estancada: Fangoso: Tierra Seca: Hojas en Árboles: ¿Está lloviendo o nevando:	Vertical Profiles Along the MODIS Centerline Cloudsat Quick Look Cloudsat Tutorial CALIPSO Expedited Browse Image CALIPSO Tutorial

Comments: No comments provided by participant.
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[View Corresponding MODIS Terra Satellite Image](#)



Helpful Links and Tutorials

S'COOL Resources

[Scool@larc.nasa.gov](http://scool.larc.nasa.gov)

9/20/12

S'COOL Lesson Plans

Find it @ S'COOL:

Search

Students' Cloud Observations On-Line

National Aeronautics and Space Administration



HOME FOR PARTICIPANTS
FOR TEACHERS » Teacher Resources »

Grade Level: Grade 8-9
Estimated Time for Completing Activity: One hour
Learning Outcomes:

- To create a thematic (or pictorial) map
- To observe weather patterns and make predictions

National Standards:

- Science Content: D Earth and Space Science
- Science Content: A Science and Inquiry
- Science Content: E Science and Technology
- Math: Data Analysis and Probability
- Math: Representation
- Geography: Places and Regions

Virginia Standards of Learning:

- Science 5.1: The student will plan and conduct an investigation in which
 - a) data are collected, recorded
 - b) predictions are made using prior knowledge
 - c) manipulated and responding to the investigation
 - d) understanding of the nature of science is developed
- Science 6.1: The student will plan and conduct an investigation in which
 - a) a classification system is developed
 - b) scale models are used to describe the system
 - c) data are organized and compared
 - d) data are investigated and conclusions are drawn
- ES 13: The student will investigate and understand the Earth. Key concepts include
 - a) observation and collection of data
 - b) prediction of weather patterns
 - c) severe weather occurrences
 - d) weather phenomena and the atmosphere
- History and Social Sciences 3.5: The student will investigate and understand the regions in the world. Key concepts include
 - a) locating the regions in the world
 - b) locating specific places on a map

Prerequisite:

- Prior knowledge of clouds and related weather phenomena
- Ability to locate sites by coordinates

scool.larc.nasa.gov/cgi-bin/view_lessonplan.cgi

Observer Information: Rover Name _____
Date (ex. 2011 09 20): Year ____ Month ____ Day ____
Local Time (24 Hour Clock: ex. 14:00) _____

① Total Cloud Cover: ____ No Clouds
Sky Visibility: ____ Unusually Clear
Sky Color: ____ Deep Blue ____ Blue

Number of Short Lived _____

② What do you see?
High Level Clouds

- Cloud Type
- ☐ Cirrus
 - ☐ Cirrocumulus
 - ☐ Cirrostratus

③ What do you see?
Mid Level Clouds

- Cloud Type
- ☐ Altostratus
 - ☐ Altoclouds

④ What do you see?
Low Level Clouds

- Cloud Type
- ☐ Fog
 - ☐ Nimbostratus
 - ☐ Cumulus
 - ☐ Stratus
 - ☐ Cumulocirrus
 - ☐ Stratocumulus

⑤ What do you observe?
Ground Measurements

- Surface Cover:
- ☐ Yes ☐ No
 - ☐ Snow
 - ☐ Sand
 - ☐ Mud
 - ☐ Dry grass
 - ☐ Leaves
 - ☐ Rain

Comments:

Use your Cloud Teller to practice vocabulary, learn different cloud types, and help with CERES S'COOL cloud observation.

- Visit the links below for more S'COOL cloud observation tips and tricks: <http://science-edu.larc.nasa.gov/>
- Observation Tips and Tricks: <http://science-edu.larc.nasa.gov/>
- Cloud Chart: <http://science-edu.larc.nasa.gov/>
- Print a Ground Observation Form and Report: http://scool.larc.nasa.gov/en_rover_obs.html
- Register your class for the CERES S'COOL: <http://science-edu.larc.nasa.gov/S'COOL/register>

To build the Cloud Teller, see instructions on the Cloud Teller page.



National Aeronautics and Space Administration

S'COOL Cloud Identification Chart



CERES S'COOL Project
Students' Cloud Observations On-Line
<http://scool.larc.nasa.gov/>
<http://scool.larc.nasa.gov/S'COOL/cloudchart.html>
scool@larc.nasa.gov

EW-2004-10-04-LaRC

Students' Cloud Observations On-Line (S'COOL)

What's Next

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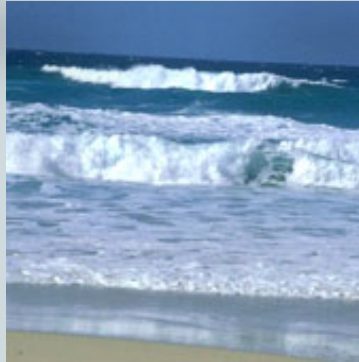
Moving Forward...

- S'COOL integration into the GLOBE Program
 - Formal application: Updated Cloud Observation Protocol, NEW hard copy materials, training slides, online data input, communication to internal and external GLOBE community, training opportunities around NEW cloud protocol
 - Informal application: Clouds is the first protocol translated to the GLOBE Observer APP, designed to extend GLOBES audience and participation
- Mission Earth partnership, vertically integrating NASA assets and resources across grade band and developing an effective educator professional development model.





The GLOBE Program: www.globe.gov



Science Protocols

Learning Activities

Data Collection

Data Visualization

Mobile Application

Virtual Science Fairs

Campaigns

<http://www.globe.gov/web/guest/home>

CERES, Engaging Educators, Students and Public Learners for the past 20 years

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You can Observe
You can Analyze
You can Be A Scientist



The Value of Science

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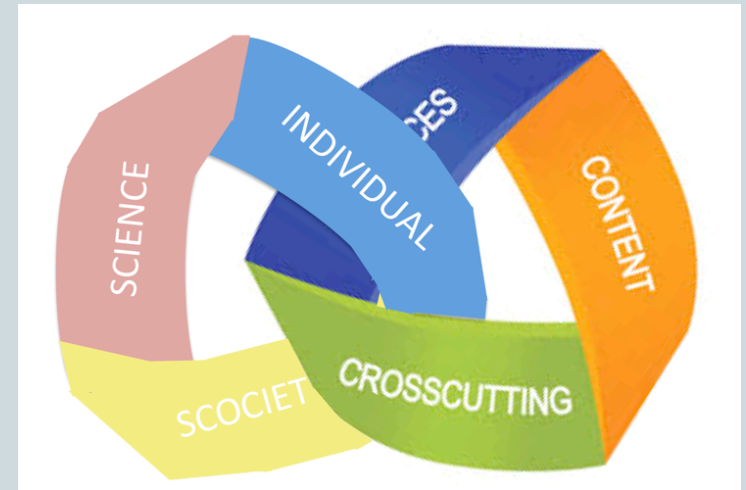
*There is Value in Engaging Citizen Scientists to
Enhance Science Understanding!*

What is Citizen Science?

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Level 4 'Extreme'	• Collaborative Science – problem definition, data collection and analysis
Level 3 'Participatory science'	• Participation in problem definition and data collection
Level 2 'Distributed Intelligence'	• Citizens as basic interpreters
Level 1 'Crowdsourcing'	• Citizens as sensors

Sui, D.Z., Elwood, S. and M.F. Goodchild (eds.), 2013. Crowdsourcing Geographic Knowledge. Berlin: Springer.



CERES, Engaging Educators, Students and Public Learners for the past 20 years

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- Research shows that students benefit greatly from being involved in scientific inquiry, because they model the actual scientific process and they are more engaged in the learning environment.
- Students learn how to collect data, interpret data, analyze data, think about the data and what might have affected the data, and present their data



Citizen Science Channels: Globe Observer

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Facebook Live App Kick Off



Data Visualization

<http://observer.globe.gov/news-events/news/-/blogs/19643529/maximized>

Citizen Science Channels

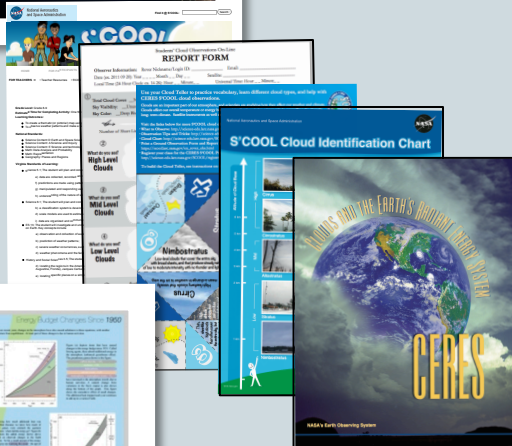
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Resources

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- Contact the NASA SD Education Team for:
 - Hardcopy Handouts
 - Activity Kits
 - Table Demonstrations
 - Presentation Content
 - Web resources



How You Can Connect!

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Why is observing, studying, and monitoring clouds important?

How You Can Share Your Science Story!

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- Collaborate with the SD Education Team throughout the year
 - GLOBE Integration Home Page Videos
 - GLOBE International Scientist/STEM Network:
<http://www.globe.gov/join/become-a-globe-scientist>
 - Professional Development, Science Material Experts, Guest Speakers
 - Research assistance, utilize citizen science community to provide otherwise inaccessible data.
 - Etc...

Thank YOU!

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We are here to help support your efforts!
sdepo@lists.nasa.gov

Sarah McCrea

Sarah.mccrea@nasa.gov

CERES, Engaging Educators, Students and Public Learners for the past 20 years

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If you don't collect a data point now, you will never be able to collect it again

Collaborating Satellite Missions

